Innovative, Rapidly Regenerable, Structured Trace-Contaminant Sorbents Fabricated Using 3D Printing, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

The NASA objective of expanding the human experience into the far reaches of space requires regenerable life support systems. This proposal addresses the fabrication of structured (monolithic), carbon-based trace-contaminant (TC) sorbents for the space suit used in Extravehicular Activities (EVAs). The proposed innovations are: (1) the use of thin-walled, structured carbon TC sorbents fabricated using three-dimensional (3D) printing; and (2) the patented low-temperature oxidation step used for the treatment of carbons derived from polymers compatible with 3D printing. The overall objective is to develop a trace-contaminant removal system that is rapidly vacuum-regenerable and that possesses substantial weight, size, and power-requirement advantages with respect to the current state of the art. The Phase 1 objectives are: (1) to demonstrate the feasibility of using 3D printing to create plastic monoliths with complex geometry, subsequently converted into effective TC sorbents upon carbonization and activation, while preserving much of their original shape and strength; (2) to demonstrate effective ammonia and formaldehyde removal in the presence of CO_2 and humidity; also, sorbent regeneration; and (3) to deliver a sorbent prototype to NASA for further sub-scale testing. This will be accomplished in three tasks: (1) Sorbent Fabrication and Characterization; (2) Sorbent Testing; and (3) Product Assessment.

Anticipated Benefits

The main application of the proposed technology would be in spacecraft life-support systems, mainly in extravehicular activities (space suit), but after modifications also in cabin-air revitalization.

The developed technology may find applications in air-revitalization on board US Navy submarines, in commercial and military aircraft, in the future air-conditioning systems for green buildings, and in advanced scuba-diving systems.

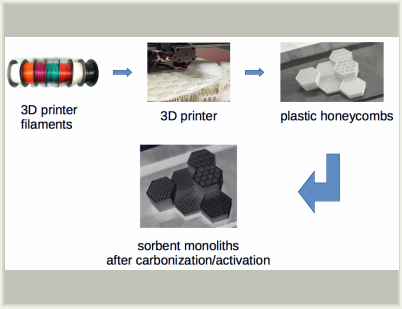

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Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

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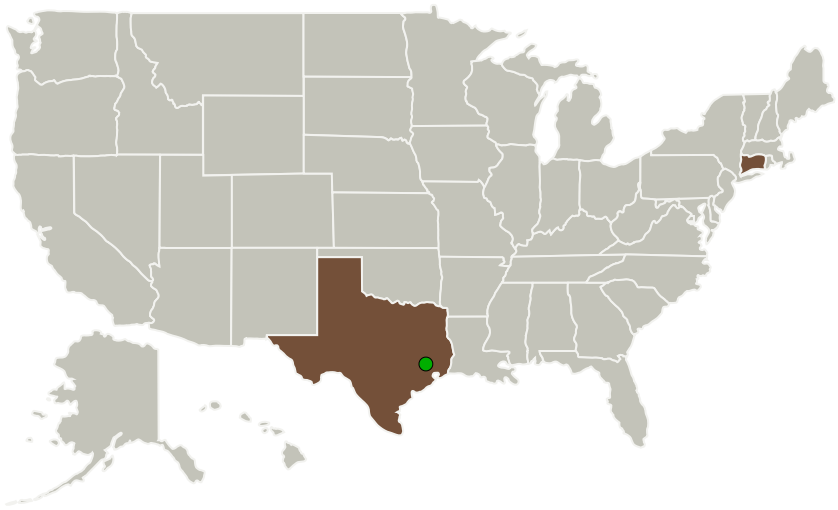
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Advanced Fuel Research, Inc.	Lead Organization	Industry	East Hartford, Connecticut
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Connecticut	Texas

Project Transitions

July 2018: Project Start

February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141110)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Advanced Fuel Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

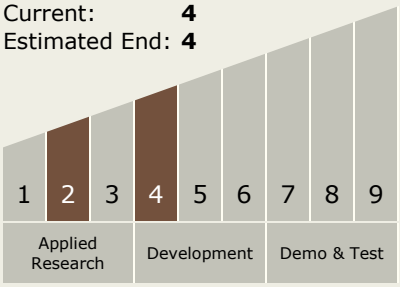
Carlos Torrez

Principal Investigator:

Marek Wojtowicz

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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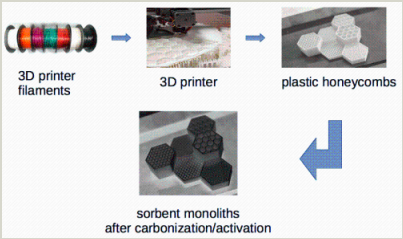
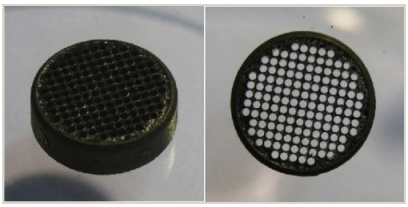
Images



Briefing Chart Image
Innovative, Rapidly Regenerable, Structured Trace-Contaminant Sorbents Fabricated Using 3D Printing, Phase I
(https://techport.nasa.gov/image/135072)



Final Summary Chart Image
Innovative, Rapidly Regenerable, Structured Trace-Contaminant Sorbents Fabricated Using 3D Printing, Phase I
(https://techport.nasa.gov/image/130193)

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.1 Atmosphere Revitalization

Target Destinations

The Moon, Mars, Earth